Small Business Innovation Research/Small Business Tech Transfer

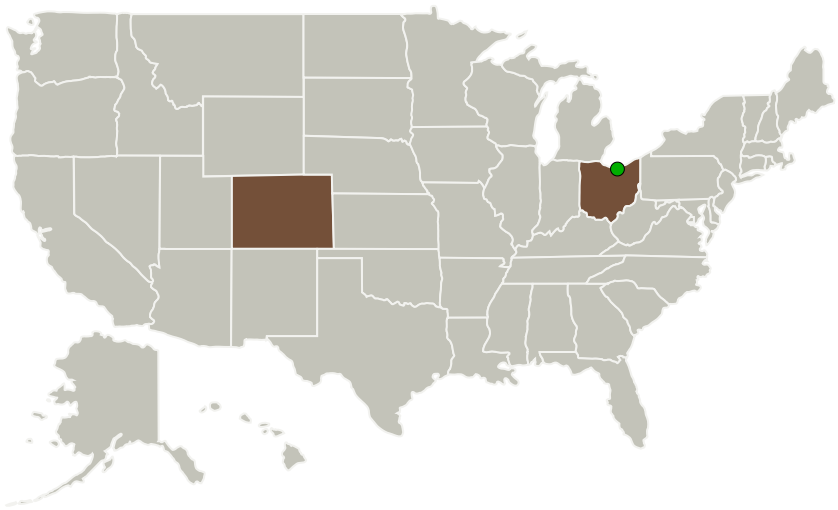
Lightweight and Compact Multifunction Computer-Controlled Strength and Aerobic Training Device, Phase I

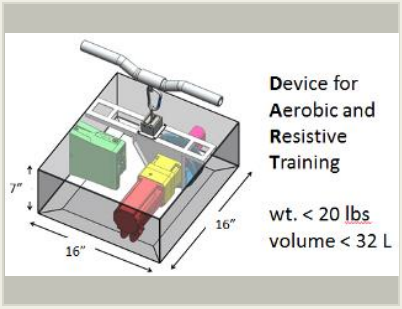
Completed Technology Project (2014 - 2014)

Project Introduction

TDA Research proposes to develop a computer-controlled lightweight and compact device for aerobic and resistive training (DART) to counteract muscular atrophy and bone loss and to improve the overall wellness of astronauts operating in microgravity. The DART will be able to provide resistive loads up to 350 lbf and will accurately simulate the load profile of a mass in a 1-g environment. It will also be capable of applying custom load profiles such as eccentric overloading. In aerobic training mode, the DART will simulate the loads of a rowing machine with loads up to 175. The system will computer-controlled and can automatically calibrate to a user's range of motion. The total weight of the device will be less than 20 lbs and have a compact form factor to enable integration into a small crew module. By using a regenerative energy recovery system, the average power consumption of the DART will be less than 100 W during an exercise session. TDA is able to build on previous experience building exercise equipment for NASA and develop the DART in a short timeframe. TDA will prove the feasibility of providing effective aerobic and resistive training with a single device that is lightweight and compact in Phase I. At the end of Phase I a prototype will be delivered to NASA for evaluation. In Phase II we will advance the technology and provide the second generation prototype to NASA for testing on the International Space Station.

Primary U.S. Work Locations and Key Partners





Lightweight and Compace Multifunction Computer-Controlled Strength and Aerobic Training Device Project Image

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

Lightweight and Compact Multifunction Computer-Controlled Strength and Aerobic Training Device, Phase I

Completed Technology Project (2014 - 2014)

Organizations Performing Work	Role	Type	Location
TDA Research, Inc.	Lead Organization	Industry	Wheat Ridge, Colorado
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Colorado	Ohio

Project Transitions

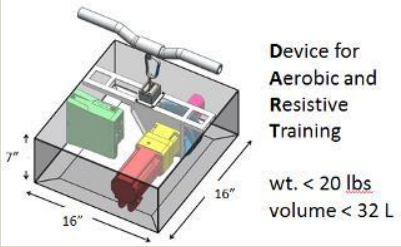
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138248)*

Images



Project Image
Lightweight and Compace Multifunction Computer-Controlled Strength and Aerobic Training Device Project Image *(https://techport.nasa.gov/image/127884)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
TDA Research, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Douwe Bruinsma

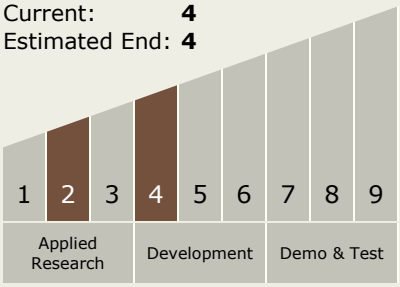
Co-Investigator:
Douwe Bruinsma

Lightweight and Compact Multifunction Computer-Controlled Strength and Aerobic Training Device, Phase I

Completed Technology Project (2014 - 2014)

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.3 Human Health and Performance
    - TX06.3.6 Long Duration Health

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System